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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/941,123	08/28/2001	Gurtej Singh Sandhu	303.676US3	6644

21186 7590 05/14/2003

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EXAMINER
MONDT, JOHANNES P

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 05/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/941,123	Applicant(s) SANDHU ET AL.
	Examiner Johannes P Mondt	Art Unit 2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *46,47 and 57-82* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *46,47 and 60-82* is/are allowed.

6)☒ Claim(s) *57-59* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/24/03 has been entered as Paper No. 10.

Response to Amendment

Amendment C filed 02/24/03 has been entered as Paper No. 8 following the Request for Continued Examination of Paper No. 10. In Amendment C Applicant substantially amended claim 59. Comments to Remarks by Applicant in said Amendment C are included below under "Response to Arguments".

Response to Arguments

Arguments by Applicant have been fully considered but are not found persuasive. In particular, the location of the titanium aluminum alloy taught by Xu et al is fully clear from Xu et al: layer 160 in the embodiment of Figure 17 is the only pure titanium (Ti) layer (the upper most sub-layer of the "liner" 150) (cf. Su et al, col. 25, l. 57 – col. 26, l. 8) and is "underlying" the aluminum filling (cf. col. 26, l. 9-13) deposited at a temperature high enough to cause the formation of the titanium aluminum alloy (col. 26, l. 9-13). Because the material constitution of the walls of the contact opening is undefined the said titanium liner can be taken to belong to the walls of the contact

opening and exposed base layer of the contact hole, the titanium alloy overlying said walls and exposed base layer, and the aluminum fill being in contact with said titanium alloy. Therefore, the rejection of claims 58-59 must be repeated.

Finally, an update has revealed prior art against claim 57 (Xing et al, 6,153,490) under 35 USC 102(e). In this respect the examiner calls attention to the notation "Ti-Al-N" as employed in Xing et al to denote an alloy rather than a compound, see for instance Fukui et al (JP407097679A).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> **(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

1. ***Claim 57*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Xing et al (6,153,490) in view of Ikeda et al (5,239,196). Xing et al teach (cf. Figures 8 and 9) a memory array (cf. col. 7, l. 9-10) within an integrated memory circuit (cf. title and abstract) comprising:

a contact having a titanium alloy layer 908 (cf. col. 10, l. 5) formed overlying walls of a contact hole 904/906/908 (cf. col. 9, l. 50-col. 10, l. 6) and a titanium silicide layer 906 (cf. col. 9, l. 59) formed overlying an exposed silicon base layer 904 (cf. col. 10, l. 4) of the contact hole (the space of the contact hole

is taken up by 904/906/908), the titanium silicide layer 906 being directly coupled to the titanium alloy layer 908, and having a composition that is different from (that of the) titanium alloy layer by virtue of its composition (titanium alloy comprising aluminum).

Xing et al do not necessarily teach the further limitation that said integrated memory circuit comprises a memory device not only comprising the said memory array, but also a control circuit operatively coupled to the memory array and an I/O circuit operatively coupled to the memory array. However, as shown by Ikeda et al, the integration into a memory device of a memory array (MAY; cf. Figure 2) with a control circuit CC operatively coupled to the memory array MB (said operative coupling is standard if not inherent for any useful control circuit to function) (cf. Figure 2 and column 29, lines 2-3) and an I/O circuit (cf. Figures 6 and 7), operatively coupled to the memory array (said operative coupling is standard if not inherent for any input to get into the memory array or output to be retrieved from it) (cf. column 60, lines 49-59), merely signifies an obvious application of said memory array. In order to exploit a memory array one has to integrate it with a control circuit for controlling the gate voltage, and exchange data with the memory array through input from and output to the outside, whence the I/O circuit of Ikeda et al.

Motivation to include said teaching by Ikeda et al into the invention by Xing et al is therefore merely the exploitation of the standard manner in which a memory array is exploited within integrated memory circuitry. *Combination* of

said teaching with said invention is straightforward as the connections to and from, and the embedding of said memory array into, the remaining circuitry does not depend on the specifics of the memory array. *Success* of the implementation of said combination can therefore be assured (and a failure to exploit said memory array at least with standard technology is otherwise almost guaranteed).

2. ***Claims 58-59*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ikeda et al (5,239,196), in view of Xu et al (6,217,721 B1). Ikeda et al teach a memory device, comprising

a memory array MAY (cf. Figure 2 and column 28, lines 60-62);

a control circuit CC operatively coupled to the memory array MB (said operative coupling is inherent for any control circuit to function) (cf. Figure 2 and column 29, lines 2-3); and

an I/O circuit (cf. Figures 6 and 7), operatively coupled to the memory array (said operative coupling is inherent for any input to get into the memory array or output to be retrieved from it) (cf. column 60, lines 49-59);

wherein at least one of the memory array, control circuit and I/O circuit comprises a contact opening or via or contact having a titanium alloy layer formed in a contact hole and a fill coupled to the titanium comprising layer. Ikeda et al do not necessarily teach said titanium comprising layer to be a titanium alloy layer nor said fill to be formed of aluminum. However, because Xu et al teach that no separate siliciding step is required for inter-level vias, provided one chooses to use aluminum for the fill 334 (cf. column 26,

lines 27-28), requiring only modest heating to about 400 degrees centigrade (cf. column 26, lines 9-11), it would have been obvious to one of ordinary skills in the art to modify the invention at the time it was made so as to include the abovementioned extraneous limitations. Moreover, as shown by Xu et al it is especially advantageous in the case of high aspect ratio contact holes to fill them with aluminum (cf. column 10, lines 4-18) that subsequently forms a high-conductivity alloy (titanium-aluminum) (cf. column 26, lines 9-11) with the titanium material of a liner of the walls (except the silicided bottom) for the purpose of increasing the electrical conductivity (cf. column 10, lines 10-32) for reduced response time. Because response time it essential to the operational quality of memory devices *motivation* is established. Because the teaching of Xu et al only would require a different filling of the same contact hole the inventions are *combinable*. Because the aluminum sputtering process (cf. abstract, line 1) taught by Xu et al is especially designed for present-day high-aspect-ratio devices and is independent of all other steps in the making of the device as taught by Ikeda et al, *success* in combining the inventions can be reasonably expected.

With regard to claim 59, the method used for producing the titanium alloy layer is irrelevant to the present device type invention as long as the claimed aspects are found in the final structure of the prior art (*claim 59*).

Double Patenting

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Omum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. ***Claims 58-59*** are provisionally rejected under the judicially created doctrine of double patenting over claim 58 of copending Application No. 09/941,125 (published as Patent Application Publication US 2002/0000662 A1). This is a provisional double patenting rejection since the conflicting claims have not yet been patented.

The subject matter claimed in the instant application is fully disclosed in the referenced copending application and would be covered by any patent granted on that copending application since the referenced copending application and the instant application are claiming common subject matter, as follows:

Both claim 58 in the application and claim 58 in the patent application 09/941,125 read verbatim:

"A memory device, comprising:

a memory array;

a control circuit operatively coupled to the memory array; and

and I/O circuit operatively coupled to the memory array;

wherein at least one of the memory array, control circuit and I/O circuit comprises a via having a titanium alloy layer formed overlying walls and an exposed base layer of a contact hole and a fill coupled to the titanium alloy layer, wherein the fill comprises a metal selected from the group consisting of tungsten and aluminum."

Claim 59 of Applicant does not further distinguish the memory device as defined in claim 58 of Applicant, as opposed to the method of making. Therefore, claim 58 in patent application 09/941,125 presents a case of double patenting for claim 59 of Applicant.

Furthermore, there is no apparent reason why applicant would be prevented from presenting claims corresponding to those of the instant application in the other copending application. See *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968). See also MPEP § 804.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fukui et al (JP407097679A).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM
May 3, 2003

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800